Space Weather Technical Forecast

Issued on Wednesday, 15 June 2022 at 13:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1 (Minor Storm) conditions Day 1 and 2 (15th and 16th). Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low in the last 24 hours with several mid-high level C-flares observed mainly emanating from AR3031, AR3030 and AR3036. The highest of these was a C8 flare from AR3031 at 14/1420UTC. There are seven numbered sunspot regions on the visible disc, the largest and most complex of which is AR3031 in the southwestern quadrant. No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind speed, as observed by DSCOVR at L1, was at slightly elevated levels, then increased to elevated levels after 15/0400UTC, settling in the range 570-600km/s. Density was mostly average but with a short-lived period of above average, peak 29 ppcc. The Total Interplanetary magnetic field strength, Bt, was weak but sharply increased to moderate strength (14nT) at the same time. The north-south component, Bz, varied weakly then fluctuated more significantly after 15/0400UTC, +11/-14 nT. The phi angle was mostly positive (away from the Sun), although has recently switched to negative (towards the Sun). Geomagnetic activity was largely Quiet, before becoming mostly Unsettled to Active from the 15/0300-0600UTC interval. The above enhancements were most likely associated with the arrival of the 13th June CME.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) was very slightly above background levels, but with no solar radiation storms thresholds reached. Electron flux (greater than 2MeV) was at background to moderate levels. Corresponding 24-hour integrated electron fluence has been well below the Active (1e8 integrated pfu) threshold on a very slight rising trend. 3.09e6 integrated pfu was observed at 15/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mostly Low, with a chance of isolated Moderate flares, most likely from AR3031.

Solar Wind / Geomagnetic Activity: The anticipated arrival of the 13th June CME was observed at L1 at around 15/0400UTC. Solar winds briefly peaked around 620km/s, and have since levelled in the range 570-600km/s. No other CMEs are currently expected to affect Earth during the period.

Solar winds may erratically decrease later today (15th), before further increases in the solar wind are anticipated with the onset of Coronal Hole/90+ early on the 16th and then Coronal Hole/92+ on the 17th, continuing into the 18th. Mainly elevated winds would be expected from the 16th onwards.

Geomagnetic activity is likely to be in the range Quiet to Active, with a chance of an isolated

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G1/Minor Storm interval, this most likely on Days 1 and 2 (15th and 16th), with a reducing risk thereafter.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be at background, or just above background levels during the period, with a slight chance of an S1 or greater event occurring. High energy electron flux (greater than 2 MeV) is expected to start at mostly background levels with a chance of increasing to moderate or perhaps high levels later in the period, due to high speed stream influences. Electron fluence is expected to follow a gradual rising trend, with a slight chance of reaching Active (1e8 integrated pfu) levels by the 18th.

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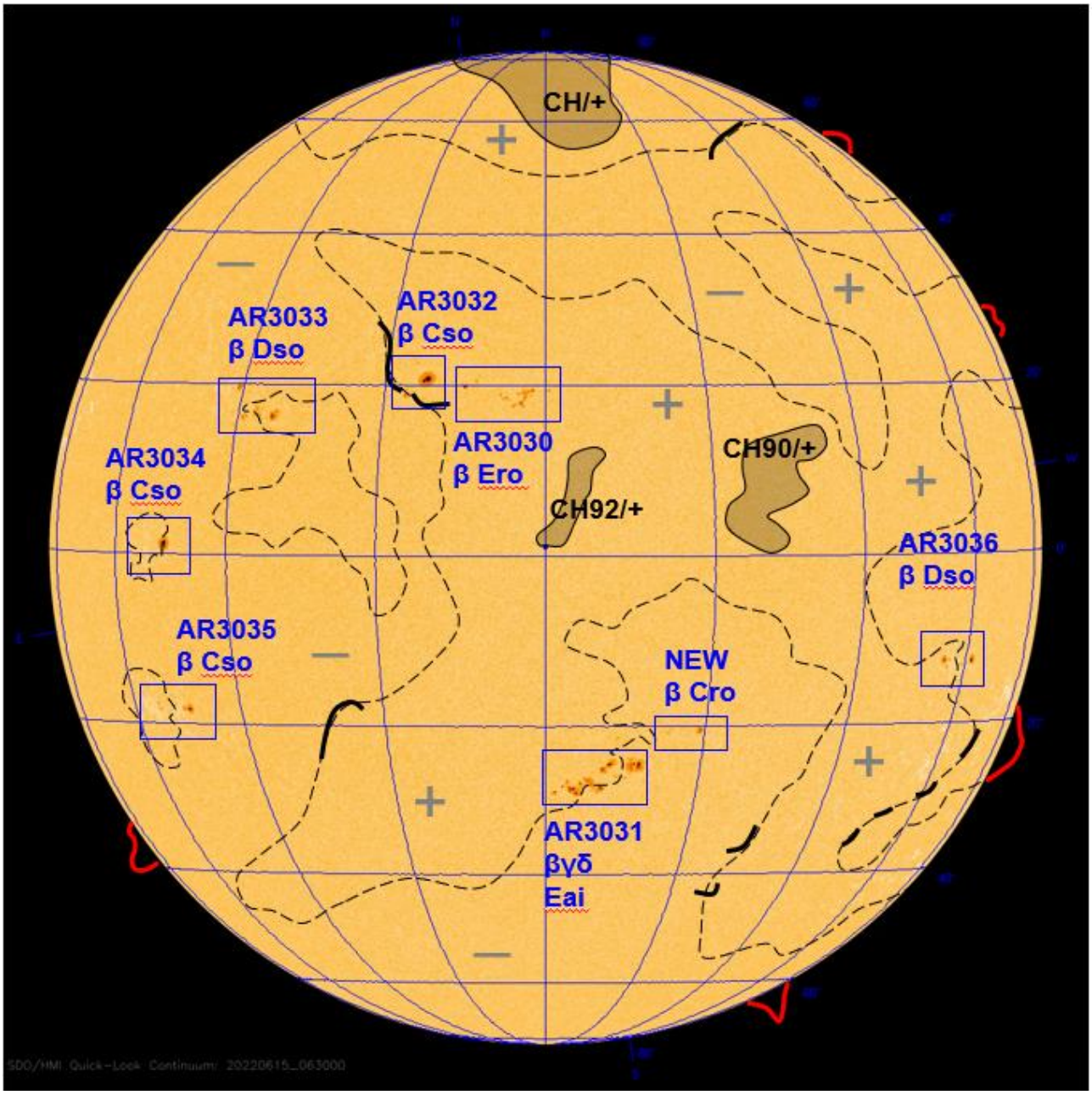
Figure 1. Solar Analysis Valid 15/0700UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A sudden impulse was observed at L1 at around 15/0400UTC, and is assessed as being the arrival of the anticipated glancing CME from 13th June. Solar winds briefly peaked around 620km/s, and have since levelled in the range 570-600km/s. No other CMEs are currently expected to affect Earth during the period.

Solar winds may erratically decrease later today (15th), before further increases in the solar wind are anticipated with the onset of Coronal Hole/90+ early on the 16th and then Coronal Hole/92+ on the 17th, continuing into the 18th. Mainly elevated winds would be expected from the 16th onwards.

Geomagnetic activity is likely to be in the range Quiet to Active, with a chance of an isolated G1/Minor Storm interval, this most likely on Days 1 and 2 (15th and 16th), with a reducing risk thereafter.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	50	50	30	10
Strong	G3	No	5	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None currently expected.

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Radio Blackouts - X-Ray Flares:

Solar activity is currently Low, with several mid-high level C-flares observed in the past 24-hours, mainly emanating from AR3031 (Eai/Beta-gamma-delta), AR3030 (Ero/Beta) and AR3036 (Dso/Beta).

There are currently seven numbered sunspots on the visible disk. AR3031 in the southern hemisphere, near the centre disc, poses the greatest risk at present for significant flares, given that it is a moderately large group with a number of fairly strong intermediate spots, including a possible small delta spot in its trailing spot. AR3030 near the centre disc in the northern hemisphere is a large group, longitudinally, but with only rudimentary penumbra at present. Other sunspots are rather simple, bipolar regions at this time, with no strong evidence of emergence or significant development.

Solar activity is expected to be mostly Low, with a chance of isolated Moderate flares, most likely from AR3031. Although AR3036 will rotate over the eastern limb in the coming days, probabilities of both M-class and X-class flares are retained as one or more bright regions in the EUVI/AIA 195 imagery, that may contain sunspots, will rotate onto the Earth-facing disc in the next couple of days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) was close to background levels, although it has been very slightly elevated from long term background readings, following C-flare activity in recent days. The risk of a proton storm remains very low, but a with slight chance of an S1 or greater event due to the transit of AR3031 across the western solar hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 is currently at background to moderate levels. Similar conditions are expected to persist between the 15-17th with the electron belts suppressed due to the influence of a CME and at least two coronal holes that follow. The risk of the electron flux becoming moderate or high increases as the high speed stream begins to weaken on the 18th, allowing the Van Allen radiation belts to recharge themselves. This will marginally increase the risk of fluence levels reaching the Active (1e8 integrated pfu), though this is much more likely to occur after the 18th.

REFM output is considered to be a little high with an anticipated rise later in the period, with values closer to recurrence more likely, thus maintaining fluence levels just below the Active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	20
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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